June 6, 1968

Dear Ray:

Enclosed is a detailed breakdown on man-hours and cost for our proposal no. 6927-59. (Microdensitometry Support). Some of these are essentially continuations of previous work (Task 1, Task 4, and Task 5). Tasks 2, 3, and 6 are additional efforts.

The work statement submitted to you earlier covers the documentation that will be provided with the computer programs. I have enclosed a copy of it for your convenience.

If you have any questions, please don't hesitate to call.

STATINTL

Sincerely,

Scientific & Engineering Applications

WWM:mls
encl

MICRODENSITOMETRY SUPPORT

Statement of Work

STATINTL   1. [   ] will provide technical assistance, as required, to establish operating procedures which will produce valid

STATINTL output from the [   ] 1032T trichromatic microdensitometer. This work will include an investigation to determine proper location of filters.

STATINTL   2. [   ] will provide information processing routines for automatic data reduction of the microdensitometer output. These routines will facilitate technical and intelligence analyses of single and multilayer emulsion films. The documentation furnished in support of these routines will include:

         a.   Complete listing of the deck for each FORTRAN program.

         b.   Documentation for each FORTRAN program consisting of:

         1.   Block diagram of the program showing the exact flow of this data and operation preformed on it.

         2.   Detailed description of all input data such as; range and number of data values; purpose, definition and values of all constants; settings on the NPIC Microdensitometer that are peculiar to the program.

         3.   Detailed description of all output data such as: range of values; what the cause could be if the values are out of range (assuming the program is in production status; what assumption and conclusion can be drawn from the output.)

         4.   Detailed description of all mathematical analysis methods in the program, equations and relevant diagrams.

5. Description of any option in the program and any other uses the program might have.

6. Glossary of terms.

c. Complete set of test data for each program including intermediate calculations and the output. Whenever possible all input data to any program will be combined on magnetic tape in the format generated by the microdensitometer. The only exception might be when input to one program is output of another.

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3. [   ] will provide test targets and test routines for establishing the validity of any scan or series of scans made on the microdensitometer.

4. [   ] will provide technical assistance, as required, in the general areas of photoscience, electronic engineering, computer programming and optical

STATINTL analysis.

5. [   ] will investigate the application of various lens combinations to reduce focus depth effects when scanning multi-layer emulsions with various wave

STATINTL length of light.

6. [   ] will provide analytical and experimental support in the development of image analysis and image processing techniques unique to the exploitation field. Particular emphasis will be placed on the deduction of fundamental object properties, e.g., brightness contours, from the recorded image. In those cases wherein the deduction of such data is not possible, the failure of physical description

STATINTL will be identified and recommendations made as to future courses of action.

7. [   ] will provide monthly status reports on the work accomplished and the funds expended. These reports will be submitted within two weeks after the

STATINTL end of the reporting period.

8. [   ] will provide a final report on the work accomplished. The rough draft of this final report will be submitted thirty days before contract termination date, and the final copies will be delivered to the customer thirty days after approval of rough draft.

I COLOR EXPOSURE TABLE GENERATOR

This task is the completion of the effective exposure table selection and generation. Without this capability, the effective exposure principle cannot be used in the computation of color MTF. This task has five subtasks as follows:

a. Completion of the characteristic matrix program

b. Scalar array computation and regression fitting to generate the equations relating image color to scalar array

c. Programming of the exposure table generator and exposure selection procedure

d. Testing of the final color exposure generator

e. Reporting and Documentation

STATINTL

TASK 1	HOURS
Executive Engineer	50
Physicist	
Analyst	
Photoscientist	85
Programmer	180
Photographic Technician	
Technical Writer	20
Publication Clerk	40
Illustrator	10
TOTAL	
Engineering Overhead (100%)	
TOTAL	
MATERIAL	
Computer Charges	
Travel	
TOTAL	
G & A at 9%	
Profit	
TOTAL	

II COLOR GRANULARITY STUDIES

This task compares the granularity of color materials with that of black and white materials on the basis of the mathematical characteristic. The investigation takes the form of examining the noise properties of color materials using three different techniques. The following sub-tasks are required:

a. Record and sample preparation

b. Study of classical gaussion properties as they relate to color materials (Selwyn's law etc.)

c. Binomial Distribution Studies

d. Cross and auto correlation programs

e. Reporting and Documentation

STATINTL

TASK 2	HOURS
Executive Engineer	50
Physicist	
Analyst	100
Photoscientist	270
Programmer	245
Photographic Technician	145
Technical Writer	20
Publications Clerk	40
Illustrator	10

     TOTAL

Engineering Overhead (100%)

     TOTAL

MATERIAL

Computer Charges

Travel

G & A at 9%

     TOTAL

Profit

     TOTAL

III COLOR MODULATION TRANSFER FUNCTION

This phase initiates the study of the properties of MTF of color emulsions. Its objective is to provide a means for MTF generation and an analysis and interpretation of their value and meaning of such measurements in the color situation. The study will be composed of the following five sub-tasks:

    a. Color target generation

    b. Cooley-Tukey transform methods (edges, combs)

    c. Standard transforms (edges, combs)

    d. Analysis

    e. Reporting & Documentation

STATINTL

TASK 3	HOURS
Executive Engineer	50
Physicist	
Analyst	100
Photoscientist	415
Programmer	390
Photographis Technician	450
Technical Writer	20
Publication Clerk	60
Illustrator	20
TOTAL	
Engineering Overhead (100%)	
TOTAL	
Material	
Computer Charges	
Travel	
G & A at 9%	
Profit	
TOTAL	

IV DIRECTION COSINE AND COLOR TRIPACK CALIBRATION

This task completes work required to implement the calibration procedure established under previous efforts. The methods are well defined and ...l programming is completed and in operation. The following tasks remain to be accomplished to make this an operational procedure.

    a. Spectrophotometric work

    b. Direction Cosine

    c. Micro-D calibration

    d. Reporting and Documentation

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TASK 4

	HOURS
Executive Engineer	50
Physicist	
Analyst	100
Photoscientist	60
Programmer	10
Photographic Technician	340
Technical Writer	20
Publication Clerk	40
Illustrator	20
TOTAL	
Engineering Overhead (100%)	
TOTAL	
Material	
Computer Charges	
Travel	
G & A at 9%	
Profit	
TOTAL	

V COLOR MICRO-DENSITOMETER QUALITY CONTROL

This phase completes an automatic, computer-oriented quality control program for the micro-densitometer. It includes preparation of the target plate, integration of the basic programs into a complete operational package, and running of material to generate a statistical history using the Q. C. system.

a. Target preparation

b. Complete all basic programming

c. Form operational package

d. Test final Q. C. package

e. Reporting & Documentation

STATINTL

TASK 5

	HOURS
Executive Engineer	
Physicist	50
Analyst	
Photoscientist	100
Programmer	170
Photographic Technician	340
Technical Writer	250
Publications Clerk	20
Illustrator	60
	20
TOTAL	
Engineering Overhead (100%)	
TOTAL	
Material	
Computer Charges	
Travel	
G & A at 9%	
Profit	
TOTAL	

VI <u>MICRO-ANALYZER OBJECTIVES ASSESSMENT</u>

Discrepancies have been noted in the selection of objectives for the current color micro-densitometer. Achromat objectives, designed for metallographic use are not suitable for the precise location of focus of the micro-densitometer with respect to the orientation of the layers of a classical color tripack. This program will evaluate the chromatic abberation and focus plane characteristics of current apo-chomat and planapo-chomat objectives.

STATINTL

TASK 6

	HOURS	
Executive Engineer	150	
Physicist	250	
Analyst		
Photoscientist		
Programmer		
Photographic Technician	500	
Technical Writer	20	
Publications Clerk	30	
Illustrator	20	
TOTAL		
Engineering Overhead (100%)		
TOTAL		
Material		
Computer Charges		
Travel		
G & A at 9%		
Profit		
TOTAL		

COMBINED TOTAL HOURS AND COST

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	HOURS
Executive Engineer	400
Physicist	250
Analyst	400
Photoscientist	1000
Programmer	1165
Photographic Technician	1685
Technical Writer	120
Publication Clerk	270
Illustrator	100
TOTAL	
Engineering Overhead (100%)	
TOTAL	
Material	
Computer Charges	
Travel	
TOTAL	
G & A @ 9%	
Profit	
TOTAL	